Identification and Reduction of Turbomachinery Noise, Phase II

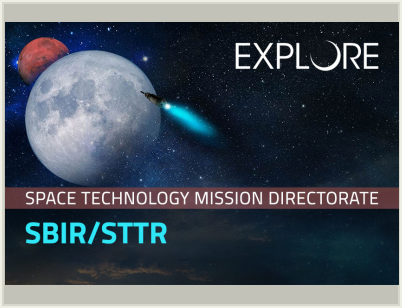
Completed Technology Project (2006 - 2008)

Project Introduction

Communities near airports are often exposed to high noise levels due to low flying aircraft in the takeoff and landing phases of flight. Propulsion source noise is the major contributor to the overall noise level. The noise generation mechanisms for a typical turbofan engine are complicated, which makes it a significant challenge to identify the noise sources. Each engine component, such as fan, compressor and turbine, can generate both broadband and narrowband noise. Particularly, the fan noise, more specifically the interaction of the rotor with the downstream stator, is important due to the trend towards the development of civil aircraft turbofan engines with higher and higher by pass ratios. Nearfield acoustical holography (NAH) refers to a process by which the noise sources and the resulting sound field can be reconstructed based on sound pressure measurements taken on a surface in the neighborhood of these sources. Thus, the development and application of appropriate generalized acoustical holography (GAH) system by extending NAH to handle arbitrary geometry and complex noise sources, novel measurement and data processing methods, and innovative inversion and regularization techniques will conceptually allow the identification and ranking of complex turbomachinery noise sources that are otherwise difficult to characterize. This system will also enable the use of more effective active and/or passive noise control measures by providing useful information that is impossible to obtain by direct measurements.

Anticipated Benefits

Potential NASA Commercial Applications: The proposed system can be adapted for the resolution of a wide range of problems such as internal combustion engine exhaust noise, low frequency radiated noise by industrial systems like vacuum pumps and forced air blowers, and automotive interior noise. There are many other situations in automotive, aerospace, heavy equipment and consumer product industries where the noise generation and interaction mechanisms are complex and as a result the applications of noise control procedures are not effectively performed. The proposed GAH system can be extended to identify these noise sources that are otherwise difficult to characterize.



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Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Glenn Research Center (GRC)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

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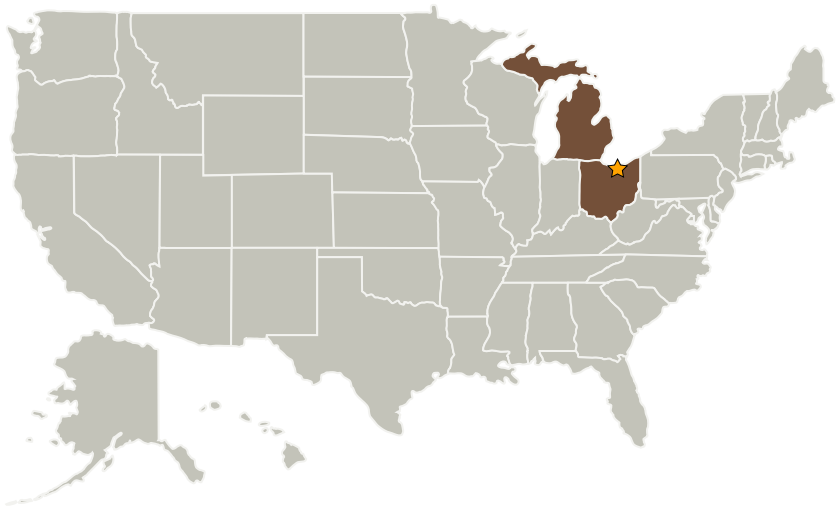
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★Glenn Research Center(GRC)	Lead Organization	NASA Center	Cleveland, Ohio
Comet Technology Corporation	Supporting Organization	Industry	Ann Arbor, Michigan

Primary U.S. Work Locations	
Michigan	Ohio

Project Transitions

December 2006: Project Start

December 2008: Closed out

Closeout Summary: Identification and Reduction of Turbomachinery Noise, Phase II Project Image

Project Management

Program Director:
Jason L Kessler

Program Manager:
Carlos Torrez

Principal Investigator:
Satha Raveendra

Technology Areas

Primary:

- TX15 Flight Vehicle Systems
  - TX15.1 Aerosciences
    - TX15.1.4 Aeroacoustics